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**EVALUATION OF U.S. DIVER'S COMPANY
'LOOK OUT' FULL FACE MASK FOR POSSIBLE
USE IN A SCUBA COMMUNICATION SYSTEM**

A. Brandenburg, et al

**Navy Experimental Diving Unit
Washington, D. C.**

March 1959

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17. ABSTRACT

The commercially available U. S. Diver's Co. "Look Out" full face mask with wrap around face plate and retractable mouthbit is given routine visual field and extensive EDB and UDT subjective testing. Quantitatively, the increase in visual field is not significant though psychologically there appears to be a great increase. There is severe distortion of vision at the edges of the field. Subjective and engineering considerations lead to the conclusion that the mask does not give sufficient promise as regards adaptation of a communication system to warrant further use.

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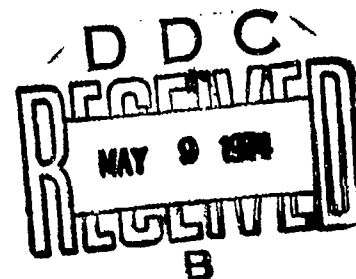
EVALUATION REPORT 15-59

EVALUATION OF U.S. DIVER'S CO. "LOOK OUT" FULL
FACE MASK FOR POSSIBLE USE IN A SCUBA
COMMUNICATION SYSTEM

PROJECT NS 186-200 SUBTASK 4 TEST 52

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23 March 1959



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SUMMARY

PROBLEM:

1. Is the U.S. Diver's Co. "Look Out" full face mask significantly superior to other commonly used masks as regards visibility?
2. Does the mask give promise of adaptation and use in a scuba communication system.

FINDINGS:

1. Quantitatively, the masks visual field perimeters are not significantly greater than other similar masks.
2. By moving the faceplate rim completely beyond the edge of the swimmer's visual field, there is a psychological effect of increased field.
3. The wrap-around face mask gives severe distortion at the edges of the field.
4. The retractable mouthbit system of providing for communication in a scuba face mask is not considered worthy of further consideration, especially in view of other more promising systems.

RECOMMENDATIONS:

1. It is recommended that the U.S. Diver's Co. "Look Out" full face mask not be accepted for U.S. Navy use.
2. It is further recommended that the manufacturer be advised that his catalog should be modified to delete "U.S. Navy approved".

ADMINISTRATIVE INFORMATION

Ref: (a) BuShips ltr ser 638-1828 of 15 August 1958 to U.S. Divers Co.
(b) BuShips ltr ser 638-1829 of 15 August 1959 to EDU.

By reference (a), the Bureau of Ships advised U.S. Divers Co., 11201 West Pico Blvd., Los Angeles, California that evaluation of that company's "Look Out" full face mask at the Experimental Diving Unit was authorized and cautioned against use of the tests or results thereof for advertising purposes. By-reference (b), the Bureau of Ships directed EDU evaluation of the mask on a priority "C" project, specifying identification of the work as Project NS 186-200, Subtask 4, Test No. 52.

The mask was received (parcel post) from the manufacturer on 12 August 1958.

C. M. PRICKETT, GMI(DV), USN AND BRANDENBURG, H. A., MRC(DV), USN were assigned jointly as Project Engineers and LCDR W. F. SEARLE, Jr., USN, as Project Officer. Work commenced on 12 November 1958 and was completed at EDU on 12 February 1959. The mask was given informal subjective field evaluation at St. Thomas, Virgin Islands in February and March 1959. The field evaluation was conducted by personnel of UDT-21 and EODTC and was supervised by the Project Officer. Charges incurred in the execution of this project were lodged against allotment 16102/59.

The following breakdown indicates the estimated manpower expended for this project:

<u>DESCRIPTION</u>	<u>MANHOURS</u>
Visual Perimeter Tests	20
EDU Subjective Trials	24
UDT/EODTC Subjective Field Trials	72
Preparation of Report	8
Drafting	2
Photography	4
Clerical Services	8
TOTAL	138

This is the first and final report under this project number. The report is issued in The Experimental Diving Unit's Evaluation Report series and is distributed only to the Bureau of Ships.

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- Figure 3 - U.S. Divers' Co. "Look Out" Full Face Mask, worn by a scuba diver.
- Figure 4 - U.S. Divers' Co. "Look Out" Full Face Mask, visual perimeter measurements.

1. INTRODUCTION

1.1 Objective

1.1.1 The object of this evaluation is to investigate the commercially available U.S. Divers Co. "Look Out" full face mask towards its possible use in the Navy, primarily as regards the possibility of installing communication features.

1.1.2 Of secondary interest is the mask's reported improved visual characteristics.

1.2 Scope

1.2.1 The scope of this project includes quantitative measurements of the field of vision following standard EDU procedures. Extensive subjective evaluation and engineering consideration is given the mask, particularly as regards adaptability of a communication system.

1.2.2 Though originally planned for inclusion on the evaluation, quantitative studies of breathing resistance and mask dead space were not conducted.

1.3 Background

1.3.1 A need exists in UDT, EOD and scientific diving for a communication system useable for scuba apparatus of all types. The current widely used mouthpiece-type breathing precludes easy voice (mouth) communication. Means of either eliminating the mouthbit completely or merely "extracting-to-talk" present themselves as essential features preliminary to the provision of adequate communication for the scuba swimmer.

2. DESCRIPTION

2.1 "Look Out" Full Face Mask

2.1.1 The mask evaluated in this report is identified in U.S. Diver's Co. 1959 catalog as follows:

"1014 'Look Out' Full Face Mask - - - \$29.95. This is a comfortable, efficient Mask long awaited by all commercial divers and sport divers who prefer the full face mask. The field of vision is terrific because of the "U" shaped, molded three-plane face plates. While looking through the front plate, the diver has a "Look Out" through the side planes. Features built-in retractible mouthpiece with non-return valves, used optionally. U. S. Navy approved."

2.1.2 The use of the term "U.S. Navy approved" in the above catalog description is not substantiated by any official U.S. Navy document or BuShips approval. Officially speaking, the statement is not correct.

2.1.3 The mask evaluated is shown in front and back view in figures 1 and 2 and as worn by a diver in figure 3. In figure 2, the retractible mouthpiece is shown pulled out.

2.1.4 The mouthpiece-tee below the faceplate contains integral 1" i.d. rubber mushroom non-return valves. The head harness has five adjustable straps 7 1/4 inches in length. The weight of the mask (less hoses) is 1 pound 10 oz. and its overall dimensions are 8 inches from side to side and 7 1/2 inches from top to bottom of the tee.

3. PROCEDURE AND RESULTS

3.1 Visual Field Perimeters

3.1.1 The visual field perimeters of the "Look Out" mask were measured following the standard procedure used at EDU as described by Workman and Prickett (EDU Evaluation Report 4-57, "Visual Field Perimeter and Distortion in Diving Masks", 1 February 1957). Field perimeter readings were taken on three experienced diver-subjects, both in and out of the water. The results (averaged for the three subjects) are presented in figure 4.

3.2 Subjective Evaluation

3.2.1 The "Look Out" mask was rigged to standard U.S. Divers Co. breathing hoses (cat. no. 1108-04) and a U.S. Divers Co. "Aqua Master" regulator (cat. no. 1010) and used by six experienced diver subjects of the Experimental Diving Unit swimming in the U.S. Naval Receiving Station (Washington, D.C.) pool. All subjects were thoroughly familiar with all usual types of face pieces, including the several "universal" masks which have been under U.S.N. development for the past several years. Subjects were instructed to observe and comment concerning field of vision, distortion, comfort of the mask and mouthpiece, ease of manipulation of the mouthpiece and clearing and flooding characteristics of the mask. Subjects were also instructed to simulate communication by talking into the mask with the mouthpiece both in and out of the mouth.

3.2.2 The "Look Out" mask was taken by EDU representatives to the UDT field trials at St. Thomas, Virgin Islands in February and March, 1959. The mask was used on open circuit scuba equipment by eight experienced swimmers of UDT-21's Test and Evaluation Unit. In addition, a series of 4000 ft. swims were made by three experienced subjects using the mask with both closed circuit (Oxygen, Mark II) and semi-closed circuit (Mixed Gas, Mark V). Depth of these latter swims was 25 to 35 feet following a 1000 ft. jack stay line in moderately clear water (Lindberg Bay). The UDT subjects were widely familiar with all standard scuba masks as well as earlier models of full face and "universal" masks. Several of the subjects had been subjects on earlier reports of similar masks as reported by the Naval Amphibious Test and Evaluation Unit. All subjects in the field trials were instructed to observe the same items as enumerated above for the swimming pool tests at EDU and in addition, general comments were invited. Comparison with other masks under test, especially as regards potential use in conjunction with anticipated communication systems, was also considered in detail.

3.2.3 The subjective comments of EDU and UDT were essentially the same and are covered together as follows:

(a) Field of Vision - All subjects reported that they felt their field was greatly increased. Specific tests of a buddy swimmer coming up alongside

confirmed this but to a lesser degree than anticipated. It was generally agreed that the mask gave at least a "feeling" of greater visibility; the increase being essentially a psychological factor.

(b) Distortion - All subjects noted a "tunneling" or "trench" - type distortion when swimming near the bottom, describing as though they were swimming down a deep trench with the bottom rising up on either side. This condition was less severe the farther the subject was above the bottom. Similar distortion at the edges of the visual field was observed by subjects simulating working on a mine. All subjects objected to this distortion of the edges of the field of vision (sides) and most felt that it negated any advantage of the increased scope of the field.

(c) Comfort of the Mask - All subjects agreed that the general comfort of the mask was satisfactory. Several indicated the straps should be lengthened to facilitate donning.

(d) Comfort of the mouthpiece - Specific description of the comments as regards the mouthpiece's comfort are difficult to generalize. Suffice to say that most subjects were mild in their objection to it specifying preference for the more usual shaped mouthpiece; two subjects were strong in their dislike of the mouthpiece; none were strong in a preference for it.

(e) Manipulation of the mouthpiece - All subjects considered this feature not necessary. Once the mouthpiece was adjusted it was left alone. Subjects felt that to use two hands to manipulate the mouthpiece every time communication was desired was unrealistic and could not be tolerated in operational conditions.

(f) Clearing and flooding - Some initial difficulty was experienced in clearing the mask but in general all subjects were able to clear after some practice. Somewhat more hand pressure is required on the mask than normal in smaller masks.

(g) Communication - All subjects simulated communication in two distinct manners as follows: (1) By putting the mouthbit at the outside of the lips and talking; (2) By retracting the mouthbit. The former method was difficult and speech was garbled but possible. (A similar procedure had been tried several years earlier on a prototype Navy mask.) The second method required the use of both hands to manipulate the retractible mouthpiece and in general some flooding always occurred upon reinsertion after completion of communication. In comparison to other methods available (specifically oral-nasal half masks), this method of providing communication in a full-face mask was not at all preferred.

3.3 Breathing Characteristics

3.3.1 It had initially been planned to include breathing resistance and dead-space studies in the evaluation of this mask. In view of the negative subjective results obtained and the relatively low priority assigned to the evaluation, this area has not been covered.

4. DISCUSSION AND CONCLUSION

4.1 Visual Characteristics

4.1.1 Comparing the results of the visual field perimeter test (figure 4) with similar masks in EDU Evaluation Report 4-57, it is apparent that the quantitative increase in field is not significant. Elimination of the mask rim at the normal limit of the field no doubt gives a psychological impression of a wider field. These results are confirmed by the subjective comments.

4.1.2 A cursory consideration of the mask's face piece with its "wrap around" glass would lead one to anticipate considerable distortion, much as is experienced in current automobiles with wrap around windshields. The situation is slightly different here, however, as the mask is fixed to the swimmer's head and he cannot readily shift his direct line of vision to be normal to the tangent of the glass's surface. Extreme distortion, objectionable to most of the swimmers, was confirmed by the subjective tests.

4.2 Communication Characteristics

4.2.1 Without doubt, a communication system could be built into the "Look Out" mask, preferably a lip microphone. Provision would have to be made for watertightness of the microphone as flooding in the mask should be anticipated each time the retractable mouthpiece is manipulated. The need for the use of practicable UDT or EOD use for communication. A mask, similar in construction, was considered as a step in the evolution several years ago of a Navy (EDU) full-face mask. The system was discarded as not satisfactory. The subjective and engineering (communication applicability) consideration of the "Look Out" mask with other existing masks at this time leads to the positive conclusion that the system is not promising and does not warrant further consideration.

4.3 Conclusion and Recommendation

4.3.1 As a consequence of quantitative visual field perimeter tests and extensive pool and field subjective tests of the U.S. Divers "Look Out" full face mask, the following conclusions are reached:

(a) The field of vision is not significantly increased though there is a psychological factor that it is.

(b) The mask gives considerable distortion at the edges of the field of vision, and is particularly objectionable to a swimmer near the bottom, following a jack stay.

(c) The prospects of the mask's adaptation to a practicable communication system for UDT/EOD swimmers is not good, a similar system having already been considered and discarded by the Navy.

4.3.2 It is recommended that the mask not be accepted for use in the Navy.

4.3.3 It is recommended that the manufacturer be advised that his catalog should be modified to delete "U.S. Navy approved" as applied to this mask.



**FIGURE 1 LOOK OUT FULL FACE MASK
FRONT VIEW SHOWING MOUTH-
PIECE TEE WITH INTEGRAL
CHECK VALVE.**



**FIGURE 2 LOOK OUT FULL FACE MASK
BACK VIEW SHOWING RETRACTABLE
MOUTH BIT EXTENDED.**

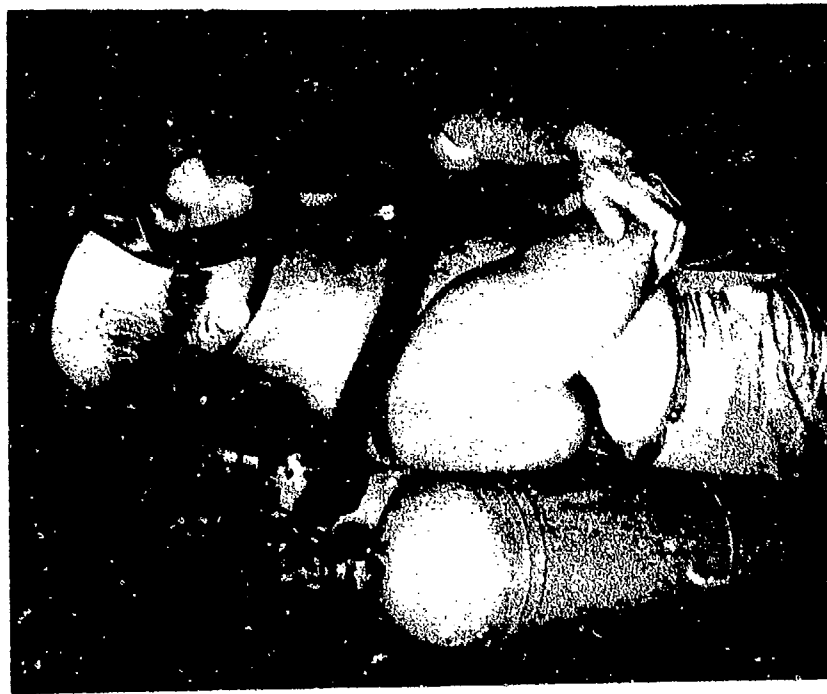


FIGURE 3A

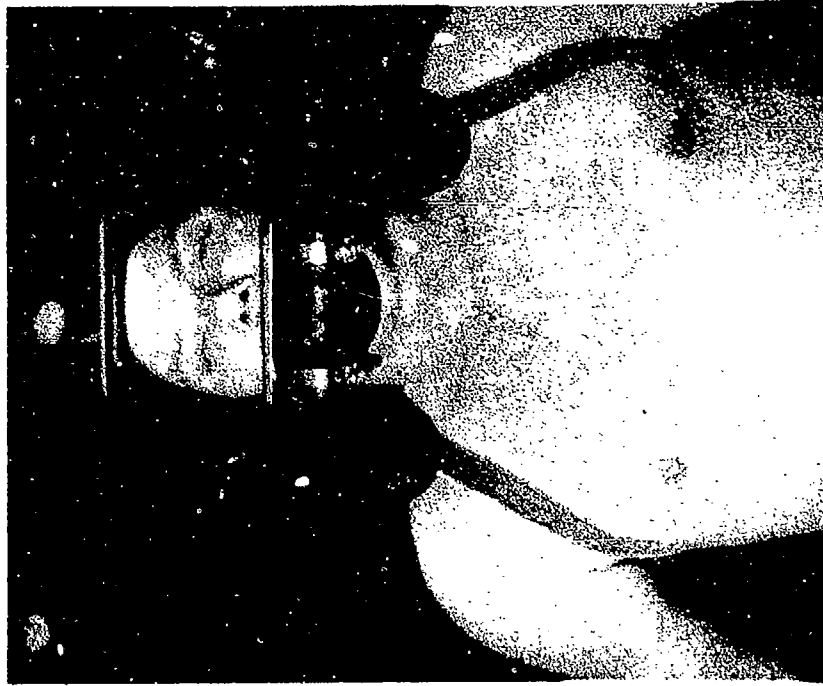
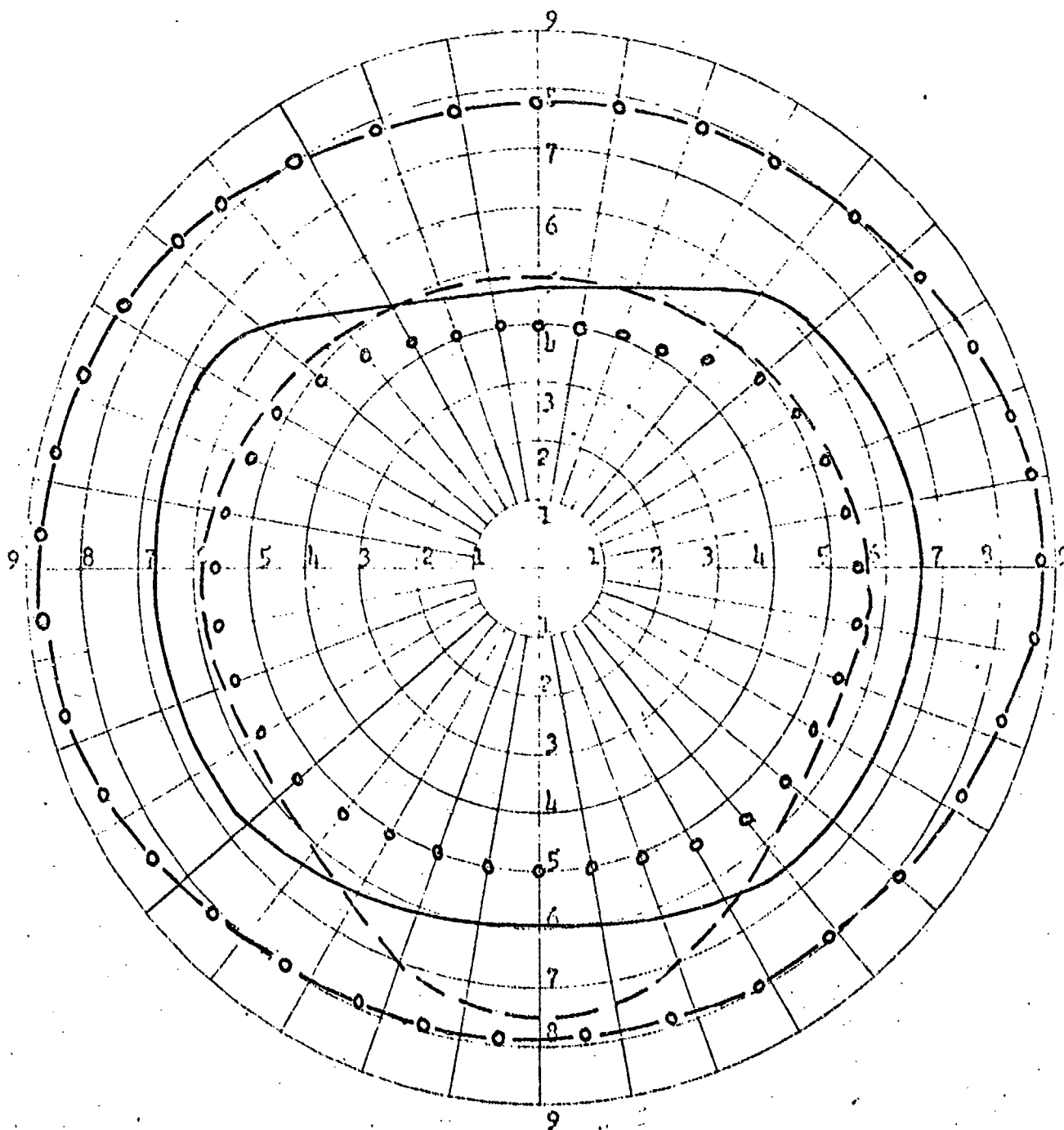


FIGURE 3B

U.S. DIVER' CO FULL FACE MASK WORN BY A SCUBA DIVER.

U.S. DIVERS CO.
 "LOOK OUT" FULL FACE MASK
 VISUAL FIELD PERIMETERS



AVERAGE OF THREE SUBJECT
 BOTH IN AND OUT OF WATER

PERIMETER - NO MASK
 PERIMETER - WITH MASK
 DISTORTION - NO MASK
 DISTORTION - WITH MASK

—○—○—○—○—
 - - - - -
 —○—○—○—○—
 ○ ○ ○ ○

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 FIG. 4